Aug. 30, 1927. 1,640,346

G. A. BRYAN

FIRE BOX FOR STEAM GENERATORS

Filed June 8, 1921 2 Sheets-Sheet 1

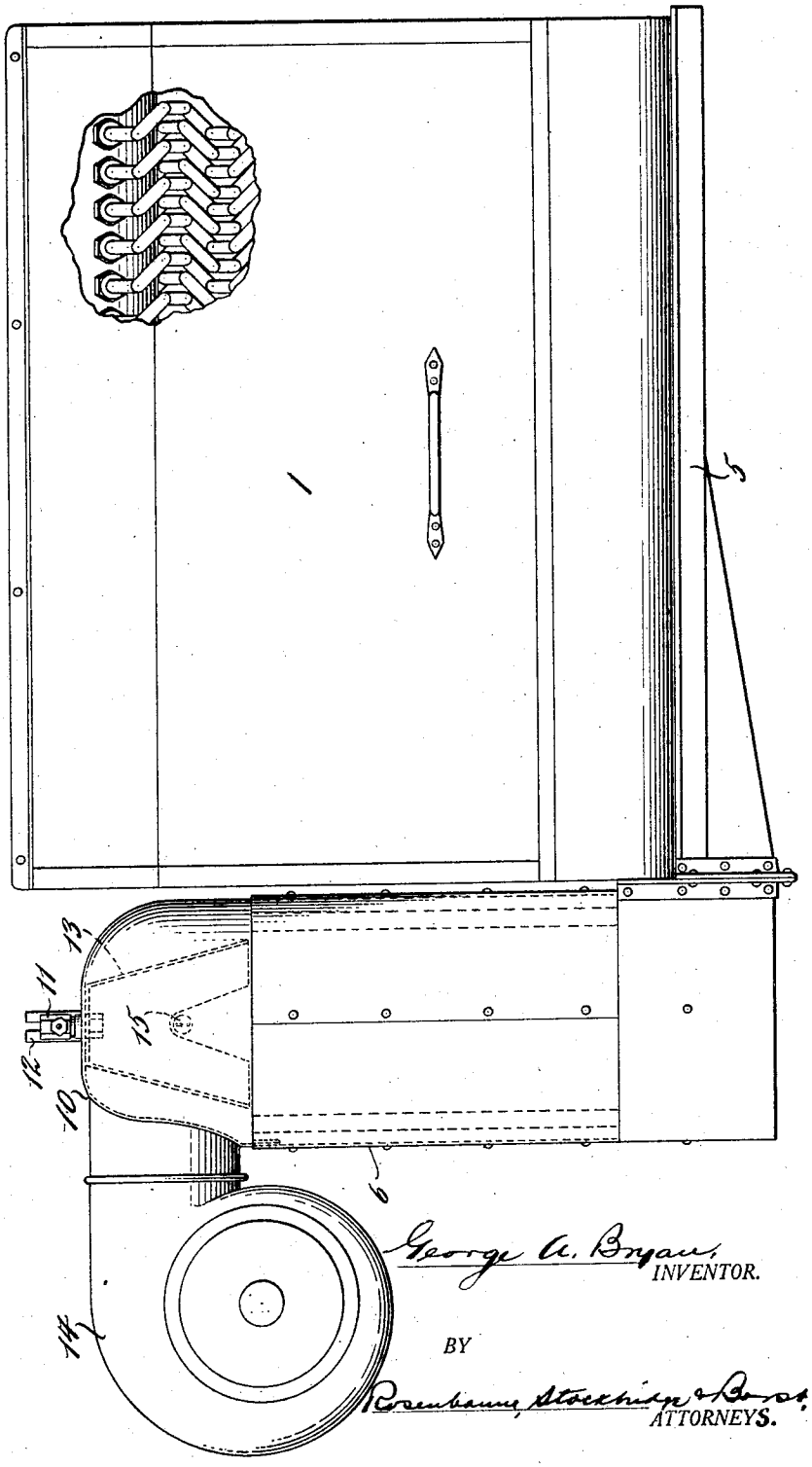


Fig. 1.

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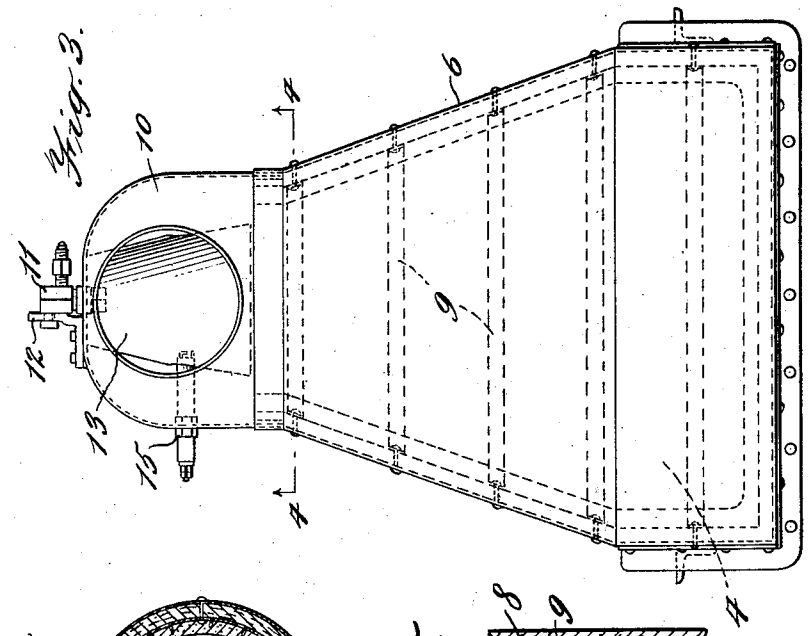


Fig. 3.

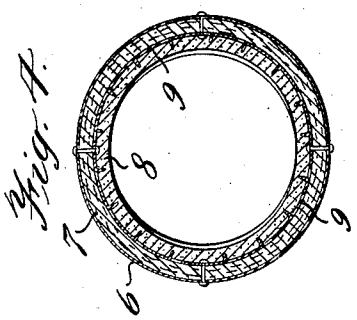


Fig. 4.

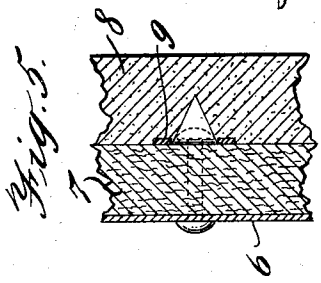


Fig. 5.

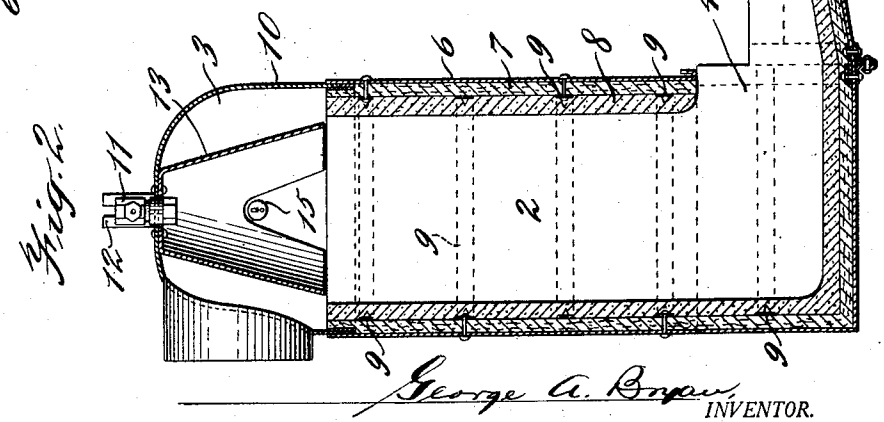


Fig. 2.

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UNITED STATES PATENT OFFICE.

GEORGE ALFRED BRYAN, OF PERU, INDIANA, ASSIGNOR TO BRYAN HARVESTER COMPANY, A CORPORATION OF NEW MEXICO.

FIRE BOX FOR STEAM GENERATORS.

Application filed June 8, 1921. Serial No. 475,989.

My invention relates to steam generating devices and particularly to small units burning liquid fuel and adaptable for use on self-propelled vehicles such as tractors, trucks, automobiles and the like. More especially my invention relates to the fire boxes or furnaces of such devices.

An object of my invention is to provide a construction which will effect complete combustion of the fuel and utilize most efficiently the available heat units. In the liquid fuel firing systems commonly used with small boilers, the burners are directly under the boiler and the comparatively cold boiler walls and tubes form the major portion of the combustion chamber of the furnace. The result is inefficiency and incomplete combustion. As the combustible mixture contacts with the cold surfaces oxidation is retarded or stopped and large deposits of carbon on the tubes result.

In accordance with my invention the fuel is completely consumed before any of the gases of combustion reach the boiler. The furnace is arranged exteriorly of the boiler housing and communicates with the same at or near the bottom which is preferably inclined upwardly from the communicating opening to cause an equal distribution of the gases over the tubes of the boiler. The furnace is preferably vertical and is of the proper height and shape to give the best rate of combustion. The height depends upon the pressure at which the fuel is delivered but is properly proportioned to cause all of the fuel to be consumed within the combustion chamber and before the gases reach the boiler.

Surmounting the combustion chamber in the preferred form is a mixing chamber through the top of which enters the spray nozzle for the fuel, and the air is furnished at this point and thoroughly mixed with the atomized fuel.

My invention also contemplates various other features of construction and arrangements and combinations of parts as will hereinafter more fully appear.

I shall now describe the illustrated embodiment of my invention and shall thereafter point out my invention in claims.

Fig. 1 is a side elevation of a complete unit embodying my invention.

Fig. 2 is a longitudinal sectional elevation of the fire box.

Fig. 3 is a rear elevation of the same.

Fig. 4 is a horizontal section of the same on line 4—4 of Figure 3.

Fig. 5 is an enlarged sectional detail of a fragment of a side wall.

The boiler 1 may be of any suitable type, but for the purpose of illustration I have shown a water tube boiler of the construction disclosed in my co-pending application Serial No. 339,945, which became Patent No. 1,497,973, June 17, 1924. The housing for this boiler has an open bottom and the gases from the furnace or fire box are delivered to this open bottom.

The fire box is of the down draft type, and comprises an upright combustion chamber 2 above which is the mixing chamber 3. The mixing chamber is shown as round in cross section, and the combustion chamber flares outwardly in its transverse dimension toward the bottom, where it is of oblong shape to make proper connection with the boiler. The combustion chamber is entirely unobstructed and has at its bottom in the side next the boiler, an opening or passageway 4 for the hot gases of combustion. The bottom of the combustion chamber has an extension 5 underneath the boiler which completes the housing for the boiler. This bottom 5 is inclined upwardly for a portion of its length to effect an even distribution of the gases over the tubes of the boiler.

The fuel is injected into the top of the mixing chamber in the form of a fine spray and is there mixed with air, the combustible mixture being ignited at the initiation of the operation. The height and diameter of the combustion chamber are determined by the pressure at which the fuel is delivered, and are in every instance such that the fuel is completely burned by the time the gases reach the passage 4.

The walls of the combustion chamber of the fire box are constructed of an outer thin metal sheet 6 lined with a sheet 7 of heat insulating material, such as asbestos, which material is covered with a layer 8 of refractory material such as fire clay or brick. As a means of securing the asbestos 7 to the metal casing 6, as well as to provide a foundation and reinforcement for the fire clay 8, a series of metal bands 9 are provided against the inner face of the asbestos throughout the height of the combustion chamber, which bands are secured by rivets passing through the asbestos and the outer metal casing. These bands 9 have inwardly projecting prongs or lugs which are struck up from the material of the bands. These prongs serve as holding means for the fire clay, which may be applied in a green state and afterwards burned into a high grade fire brick. These prongs also serve to reinforce the material 8 and enable it to withstand the vibrations to which the vehicle will be subjected.

Surmounting the combustion chamber and forming the mixing chamber 2 is a dome 10 of sheet metal, the lower edge of which is secured in any suitable manner to the top of the walls of the combustion chamber. A suitable spray nozzle 11 for the fuel enters the closed top of this dome 10, being supported in place by a lug 12 on top of the dome. Surrounding the inner end of the nozzle 11 is a conical baffle or shield 13 for the atomized fuel which extends down substantially to the bottom of the mixing chamber and is cut out at its two sides as shown. The air is delivered by a fan 14 against the face of this baffle 13 intermediate the cut-out portions. The initial lighting of the combustible mixture may be done in any suitable way, as by a pilot light or a match, or, as in the illustrated construction, by a spark plug 15. The details of this atomizing and mixing construction form the subject matter of my co-pending application Serial Number 478,682, filed June 18, 1921, (Patent No. 1,462,261, dated July 17, 1923).

The walls of the combustion chamber become thoroughly heated in a short time after the burner is started and these walls will retain their heat for a considerable period of time and serve to ignite the combustible mixture. The fuel may therefore be shut off either manually or automatically when the requisite steam pressure is obtained and again turned on as the pressure begins to fall, the mixture being ignited by the residual heat in the walls of the fire box. Any suitable automatic control system for the fuel pump and fan may be employed, for instance, that illustrated in my prior Patent #1,316,680, dated September 23, 1919.

It will be noted that the furnace is so constructed that it has no arches or overhanging walls of refractory material commonly found in this type of furnace. The delivery of the fuel through a nozzle in the top of the mixing chamber is a feature of safety in that any dripping from the nozzle after the fuel is turned off, falls to the bottom of the furnace where it is instantly flashed into a gas by the hot wall or is subsequently burned when the burner is again ignited. When the furnace is properly handled all danger from explosions due to gas or oil coming in contact with surfaces that cool them to such an extent that they cannot be burned, is eliminated.

Tests have shown that any grade of liquid fuel may be burned in my furnace, from a very low grade distillate to the higher grades of kerosene or motor fuel.

It is obvious that various modifications may be made in the construction shown in the drawings and above particularly described, within the principle and scope of my invention.

I claim:

1. In combination with a steam generator including a boiler and a housing therefor, a fire box exterior of the housing and communicating therewith and having a combustion chamber comprising a sheet metal outer casing, heat insulating material lining the sheet metal casing, and refractory material covering the heat insulating material and applied in a continuous layer while in a plastic condition.

2. In combination with a steam generator including a boiler and a housing therefor, a fire box exterior of the housing and communicating therewith and having a combustion chamber comprising a sheet metal outer casing, heat insulating material lining the sheet metal casing, bands of sheet material having inwardly projecting prongs or lugs and disposed against the heat insulating material and secured thereto by devices passing through the heat insulating material and the metal casing, and a layer of refractory material covering the heat insulating material and secured and reinforced by the prongs or lugs on the bands.

3. In combination with a steam generator including a boiler and a housing therefor, a fire box exterior of the housing and communicating therewith and having a combustion chamber comprising a sheet metal outer casing, heat insulating material lining the sheet metal casing, bands of sheet material having inwardly projecting prongs or lugs and disposed against the heat insulating material and secured thereto by devices passing through the heat insulating material and the metal casing, a layer of refractory material covering the heat insulating material and secured and reinforced by the prongs or lugs on the bands; a mixing chamber surmounting the combustion chamber,

and means for delivering atomized liquid fuel and an oxidizing fluid to the mixing chamber.

4. In combination with a steam generator including a boiler and a housing one end of which has near its bottom an opening for the admission of gases, and the bottom of which is inclined upwardly from said opening, a fire box comprising a vertical combustion chamber communicating at its bottom directly with the said opening in the housing, a mixing chamber surmounting the combustion chamber, and atomizing mechanism for liquid fuel in said mixing chamber.

In witness whereof, I hereunto subscribe my signature.

GEORGE ALFRED BRYAN.